REMARKS

The present Amendment amends claims 17-20. Therefore, the present application has pending claims 17-20.

Specification

As indicated below, Applicants amended claim 17 to overcome the Examiner's objection. Applicants also amended the title of the invention to correspond to the amendments made to claim 17.

Claim Objections

Claim 17 stands objected to due to informalities noted by the Examiner. Amendments were made to claim 17 to correct the informalities. Therefore, this objection is overcome and should be withdrawn.

35 U.S.C. §103 Rejections

Claims 17-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Database Techniques for Archival of Solid Models* by McWherter, et al. ("McWherter") in view of U.S. Patent Application No. 2002/0042697 to Yamada, et al. ("Yamada"). This rejection is traversed for the following reasons. Applicants submit that the features of the present invention, as now more clearly recited in claims 17-20, are not taught or suggested by McWherter or Yamada, whether taken individually or in combination with each other in the manner suggested by the Examiner. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

Amendments were made to the claims to more clearly describe features of the present invention. Specifically, amendments were made to the claims to more

clearly recite that the present invention is directed to an analytical model producing apparatus as recited, for example, in independent claim 17.

The present invention, as recited in claim 17, provides an analytical model producing apparatus. The apparatus includes a means for entering a shape model to be analyzed, a database which maps each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made, and a degree of approximation calculating means. The degree of approximation calculating means includes means for producing associated information of shape elements by comparing shape elements in the shape model to be analyzed with shape elements in the shape models previously made and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made. The degree of approximation calculating means also includes means for calculating a degree of approximation of the shape elements of the shape models previously made based on the number of shape elements of the shape model to be analyzed and the number of shape elements of the shape model previously made associated with the associated information of the shape elements. The degree of approximation calculating means further includes means for displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen. Furthermore, the degree of approximation calculating means includes means for selecting, in response to an instruction, at least one of the shape models previously made from among the shape models previously made displayed. Also included in the degree of approximation calculating means is an analytical

model producing means for producing an analytical hexahedron mesh model of the shape model to be analyzed which has a number of divisions of a ridge and a direction of ridge arrangement corresponding to the number of divisions of the ridge and the direction of ridge arrangement of the shape model previously made selected by the means for selecting, in accordance with the associated information of the shape elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made. The prior art does not teach or suggest all of these features.

The above described features of the present invention, as now more clearly recited in the claims, are not taught or suggested by any of the references of record. Specifically, the features are not taught or suggested by either McWherter or Yamada, whether taken individually or in combination with each other.

McWherter teaches database techniques for the archival of solid models. However, there is no teaching or suggestion in McWherter of the analytical model producing apparatus as recited in claim 17 of the present invention.

McWherter discloses techniques for managing solid models in modern relational database management systems. The goal of these techniques is to enable support for traditional database operations (sorting, distance metrics, range queries, nearest neighbors, etc.) on large databases of solid models. McWherter's techniques involve constructing a mapping from the boundary representation of a solid model to a graph-based data structure called a Model Signature Graph. The graphs are then projected into vector spaces, and distances between models based

on the distances of their images in these spaces are examined. These distances become central elements in indexing and clustering of the solid models.

One feature of the present invention, as recited in claim 17, includes a database that maps each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made. McWherter does not disclose this feature. For example, as shown on page 80, column 2 (section 3), McWherter teaches mapping from a boundary representation of solid models to a graph-based data structured called the model signature graph. The model signature graph is quite different from the analytical hexahedron mesh models of the present invention.

Another feature of the present invention, as recited in claim 17, includes a degree of approximation calculating means, which includes a means for producing associated information of shape elements by comparing shape elements in the shape model to be analyzed with shape elements in the shape models previously made, and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made. McWherter does not disclose this feature.

For example, with reference to Fig. 1 and the text that accompanies Fig. 1, McWherter discloses a technique for the transformation from a solid model to a model signature to be used for database clustering. As shown and described, a mapping from the boundary representation of a solid model is constructed. This mapping is a graph-based data structure referred to as the Model Signature Graph. Two alternative projections from the Model Signature Graph to vector spaces are

developed, based on the semantic and structural properties in the graph. The object of this technique is to store a collection of CAD/CAM models in a database and to perform efficient search and retrieval of these models. In addition, the object is to cluster the collection of these models in order to extract information regarding the structure and distribution of the models in the database. These features of McWherter, of transforming from a solid model to a model signature to be used for database clustering and indexing, are quite different from producing associated information, in the manner claimed. More specifically, McWherter's technique is not the same as producing associated information of shape elements by **comparing** shape elements in the shape model to be analyzed with shape elements in the shape models previously made, and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made. McWherter, which is merely directed to archiving solid models in a relational database management system, does not teach or suggest producing associated information of shape elements, by **comparing** shape elements of an input shape model (i.e., the shape model to be analyzed input by way of the means for entering a shape model to be analyzed) with shape elements of shape models in a template (i.e., shape models previously made), as claimed.

In response to Applicants arguments regarding this feature, the Examiner notes that the claims do not recite the terms "input shape model" and "shape models in a template". Although the Examiner is correct in this assertion, the claims do recite comparing shape elements in "the shape model to be analyzed" (an input shape model), with shape elements in "the shape models previously made" (shape

models in a template). As previously discussed, McWherter does not teach or suggest **comparing** shape elements, and in the response to Applicants' arguments, the Examiner has not indicated why the Examiner persists in the asserting that McWherter teaches **comparing** shape elements, in the manner claimed. ***Accordingly, Applicants respectfully request that the Examiner either specifically point out where McWherter teaches comparing shape elements, as claimed, or to withdraw the rejection.***

Yet another feature of the present invention, as recited in claim 17, includes where the degree of approximation calculating means includes a means for calculating a degree of approximation of the shape elements of the shape models previously made, based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements. McWherter does not disclose this feature.

As previously discussed, McWherter does not teach producing associated information of shape elements, in the manner claimed. Therefore, it follows that McWherter does not teach a means for calculating a degree of approximation based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements.

Furthermore, as described in Section 3.2 (pages 81-82), McWherter merely discloses techniques of spectral graph theory as a basis for approximating graph similarity among model signature graphs. These techniques are used to approximate graph similarity among a set of template graphs. This is not the same as a means for calculating a degree of approximation of shape elements of the

shape models previously made based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements, in the manner claimed.

In response to Applicants' arguments regarding this feature, the Examiner asserts that Applicants' argument provide no insight into how the claimed invention operates or has inherent functionality that distinguishes from the reference applied. Applicants respectfully disagree.

As previously discussed, Section 3.2 (pages 81-82) of McWherter merely discloses techniques of spectral graph theory as a basis for approximating graph similarity among model signature graphs. These techniques are used to approximate graph similarity among a set of template graphs. This is not the same as a means for calculating a degree of approximation of shape elements of the shape models previously made (i.e, template shape models) based on the number of shape elements of the shape model to be analyzed (i.e., input shape model) associated with the associated information of the shape elements, in the manner claimed. In other words, approximating graph similarity among a set of template graphs is quite different from calculating a degree of approximation of shape models previously made based on the number of shape elements of the shape model to be analyzed. Accordingly, contrary to the Examiner's assertions, McWherter does not teach or suggest the claimed feature.

In further response to Applicant's arguments, the Examiner asserts that the associated information is taught by McWherter on page 81, Section 3.1, 4th paragraph. However, the Examiner does not provide any support for the assertion

that McWherter teaches calculating a degree of approximation of shape models previously made based on the number of shape elements of the shape model to be analyzed, in the manner claimed. ***Accordingly, Applicants respectfully request that the Examiner either point out where McWherter teaches calculating a degree of approximation of shape models previously made based on the number of shape elements of the shape model to be analyzed, or withdraw the rejection.***

Still yet another feature of the present invention, as recited in claim 17, includes a means for displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen. McWherter does not disclose this feature.

To support the assertion that McWherter teaches this feature, the Examiner cites Fig. 2 on page 81. However, as described on page 81, Fig. 2 illustrates a transformation from the boundary representation of a solid model for a motor crankcase into a Model Signature Graph. A Model Signature Graph is a specialized graph structure used to represent solid models with the intention of performing similarity comparisons (see Section 3.1 on page 81). The structure shown in Fig. 2 is constructed from the boundary representation of the solid model for the motor crankcase. This display of a motor crankcase and the Model Signature Graph for the motor crankcase is not the same as displaying sequentially the shape models previously made from a larger to smaller degrees of approximation on a display screen as in the present invention. In the present invention, the means for displaying, as claimed, has advantageous features. For example, by sequentially

displaying the shape models previously made on the screen from larger to smaller degrees of approximation, it is easy to select with certainty an appropriate previously made shape model as a template for producing an analytical mesh mode of the shape model to be analyzed. By way of further example, good quality of the analytical mesh model of the shape model to be analyzed in prepared in a short time. Accordingly, McWherter does not teach this claimed feature.

In response to Applicants' arguments that McWherter does not teach this feature, the Examiner asserts that McWherter teaches that Range queries and K nearest neighbor queries are specifically designed for the McWherter invention. The Examiner further asserts that the display of such a result from the queries is found on page 85, Figs. 3 and 4. However, neither the cited text, nor any other portion of McWherter teaches or suggests the claimed feature. For example, Figs. 3 and 4 merely show examples of a set of models from the National Design Repository with extremely small distance, and with extremely large distance, respectively. This is not the same as the present invention – namely, displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen.

Another feature of the present invention, as recited in claim 17, includes an analytical model producing means for producing an analytical hexahedron mesh model of the shape model to be analyzed which has a number of divisions of a ridge and a direction of ridge arrangement corresponding to the number of divisions of the ridge and the direction of ridge arrangement of the shape model previously made selected by the means for selecting, in accordance with the associated information of

the shape elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made. McWherter does not disclose this feature, and the Examiner does not rely upon McWherter for teaching an analytical model producing means.

Therefore, McWherter fails to teach or suggest "a database which maps each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made" as recited in claim 17.

Furthermore, McWherter fails to teach or suggest "means for producing associated information of shape elements by comparing shape elements in the shape model to be analyzed with shape elements in the shape models previously made and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made" as recited in claim 17.

Furthermore, McWherter fails to teach or suggest "means for calculating a degree of approximation of the shape elements of the shape models previously made based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements," as recited in claim 17.

Even further, McWherter fails to teach or suggest "means for displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen" as recited in claim 17.

Yet even further, McWherter fails to teach or suggest "an analytical model producing means for producing an analytical hexahedron mesh model of the shape

<u>model to be analyzed which has a number of divisions of a ridge and a direction of ridge arrangement corresponding to the number of divisions of the ridge and the direction of ridge arrangement of said shape model previously made selected by the means for selecting, in accordance with the associated information of the shape elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made</u>" as recited in claim 17.

The above noted deficiencies of McWherter are not supplied by any of the other references of record, namely Yamada, whether taken individually, or in combination with each other. Therefore, combining the teachings of McWherter and Yamada in the manner suggested by the Examiner still fails to teach or suggest the features of the present invention as now more clearly recited in the claims.

Yamada teaches a method, apparatus and system for generating and analyzing a mesh for a shape model. However, there is no teaching or suggestion in Yamada of the analytical model producing apparatus as recited in claim 17 of the present invention.

Yamada discloses the formation of a conventional mesh as sample in order to generate a high-quality mesh for a predetermined shape model. The mesh generation system of Yamada includes a mesh characteristic extraction unit for receiving a conventional mesh, and for extracting a characteristic from. The system further includes a mesh generator for receiving a target shape model for mesh generation, and for generating a mesh for the shape model, based on the characteristic of the conventional mesh extracted by the mesh characteristic extraction unit.

One feature of the present invention, as recited in claim 17, includes a database that maps each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made. Yamada does not disclose this feature. Specifically, Yamada does not teach or suggest mapping each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made, as in the present invention.

Another feature of the present invention, as recited in claim 17, includes a degree of approximation calculating means, which includes a means for producing associated information of shape elements by comparing shape elements in the shape model to be analyzed with shape elements in the shape models previously made, and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made. Yamada does not disclose this feature, and the Examiner does not rely upon Yamada for teaching a degree of approximation calculation means, as claimed.

Another feature of the present invention, as recited in claim 17, includes where the degree of approximation calculating means includes a means for calculating a degree of approximation of the shape elements of the shape models previously made, based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements. Yamada does not disclose this feature, and the Examiner does not rely upon Yamada for teaching a degree of approximation calculating means, as claimed.

Yet another feature of the present invention, as recited in claim 17, includes a means for displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen. Yamada does not disclose this feature, and the Examiner does not rely upon Yamada for teaching this feature.

Still yet another feature of the present invention, as recited in claim 17, includes an analytical model producing means. The analytical model producing means prepares an analytical mesh model of the shape model to be analyzed, by use of attribute information prepared for the analytical mesh model corresponding to the at least on already prepared shape model selected by the means for selecting, in accordance with the associated information of the shape elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made. Yamada does not disclose this feature.

For example, in paragraphs [0078] to [0081 and in Fig. 9, Yamada discloses the processing performed by a mesh generation system. However, there is no teaching or suggestion in Yamada of an analytical model producing means for producing an analytical <u>hexahedron</u> mesh model of the shape model to be analyzed, in the manner claimed. Furthermore, there is no teaching or suggestion in Yamada of where the shape model has a number of divisions of a ridge and a direction of ridge of arrangement corresponding to the number of divisions of the ridge and the direction of ridge arrangement of the shape model previously made selected by the means for selecting, in accordance with the associated information of the shape elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made, in the manner claimed.

Therefore, Yamada fails to teach or suggest "a database which maps each of a plurality of shape models previously made together with analytical hexahedron mesh models corresponding to the shape models previously made" as recited in claim 17.

Furthermore, Yamada fails to teach or suggest "means for producing associated information of shape elements by comparing shape elements in the shape model to be analyzed with shape elements in the shape models previously made and associating the shape elements in the shape model to be analyzed with the shape elements in the shape models previously made" as recited in claim 17.

Further, Yamada fails to teach or suggest "means for calculating a degree of approximation of the shape elements of the shape models previously made based on the number of shape elements of the shape model to be analyzed associated with the associated information of the shape elements," as recited in claim 17.

Even further, Yamada fails to teach or suggest "means for displaying sequentially the shape models previously made from larger to smaller degrees of approximation on a display screen" as recited in claim 17.

Yet even further, Yamada fails to teach or suggest "an analytical model producing means for producing an analytical hexahedron mesh model of the shape model to be analyzed which has a number of divisions of a ridge and a direction of ridge arrangement corresponding to the number of divisions of the ridge and the direction of ridge arrangement of said shape model previously made selected by the means for selecting, in accordance with the associated information of the shape

elements between the shape elements in the shape model to be analyzed and the shape elements in the shape models previously made" as recited in claim 17.

Both McWherter and Yamada suffer from the same deficiencies, relative to the features of the present invention, as recited in the claims. Therefore, combining the teachings of McWherter and Yamada in the manner suggested by the Examiner does not render obvious the features of the present invention as now more clearly recited in the claims. Accordingly, reconsideration and withdrawal of the 35 U.S.C. §103(a) rejection of claims 17-20 as being unpatentable over McWherter in view of Yamada are respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references used in the rejection of claims 17-20.

In view of the foregoing amendments and remarks, Applicants submit that claims 17-20 are in condition for allowance. Accordingly, early allowance of claims 17-20 is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Mattingly, Stanger, Malur & Brundidge, P.C., Deposit Account No. 50-1417 (referencing Attorney Docket No. 389.41181X00).

Respectfully submitted,

MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C.

Donna K. Mason

Donna K. Mason
Registration No. 45,962

DKM/cmd
(703) 684-1120